GROUP 37

POWER STEERING

CONTENTS

GENERAL INFORMATION 37-2

SPECIFICATIONS 37-2

GENERAL SPECIFICATIONS 37-2
SERVICE SPECIFICATIONS 37-2
LUBRICANTS 37-3
SEALANTS 37-3

POWER STEERING DIAGNOSIS . . . 37-4

INTRODUCTION TO POWER STEERING DIAGNOSIS 37-4
POWER STEERING DIAGNOSIS TROUBLESHOOTING STRATEGY 37-4
SYMPTOM CHART. 37-4
SYMPTOM PROCEDURES 37-5

SPECIAL TOOLS. 37-12

ON-VEHICLE SERVICE. 37-13

STEERING WHEEL FREE PLAY CHECK . 37-13
STEERING ANGLE CHECK. 37-14
TIE ROD END BALL JOINT BREAKAWAY TORQUE CHECK 37-14
STATIONARY STEERING EFFORT CHECK 37-15
STEERING WHEEL RETURN TO CENTER CHECK 37-16
DRIVE BELT TENSION CHECK. 37-16
FLUID LEVEL CHECK 37-16
FLUID REPLACEMENT 37-17
POWER STEERING SYSTEM AIR BLEEDING 37-17
OIL PUMP PRESSURE TEST 37-18
POWER STEERING PRESSURE SWITCH CHECK 37-19
TIE ROD END BALL JOINT DUST COVER CHECK 37-20
STEERING COLUMN SHAFT ASSEMBLY SHOCK ABSORBING MECHANISM CHECK 37-20

STEERING WHEEL*. 37-21

REMOVAL AND INSTALLATION 37-21

STEERING COLUMN SHAFT ASSEMBLY* 37-25

REMOVAL AND INSTALLATION 37-25
DISASSEMBLY AND ASSEMBLY 37-27

POWER STEERING GEAR BOX AND LINKAGE* 37-29

REMOVAL AND INSTALLATION 37-29
INSPECTION. 37-31
DISASSEMBLY AND ASSEMBLY 37-32

POWER STEERING OIL PUMP ASSEMBLY. 37-35

REMOVAL AND INSTALLATION 37-35
INSPECTION. 37-36

POWER STEERING HOSES 37-37

REMOVAL AND INSTALLATION 37-37

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

⚠ WARNING

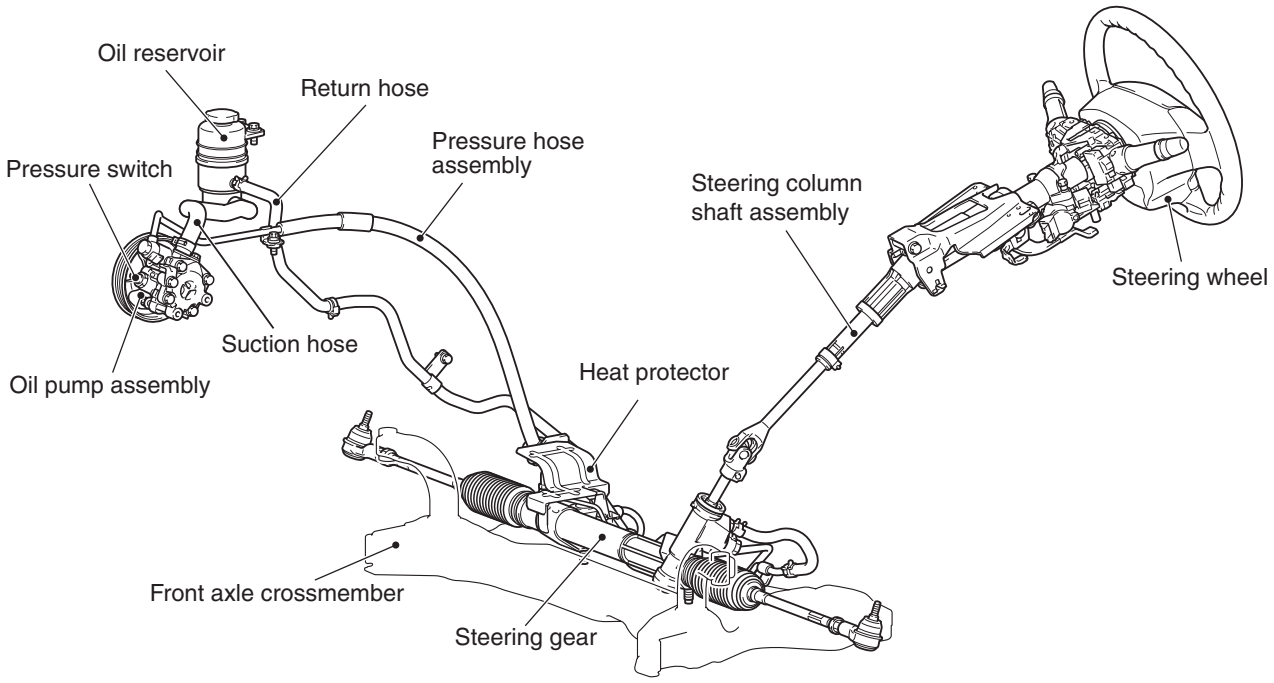
- ***Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver and passenger (from rendering the SRS inoperative).***
- ***Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.***
- ***MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B - Supplemental Restraint System (SRS) before beginning any service or maintenance of any component of the SRS or any SRS-related component.***

NOTE
The SRS includes the following components: SRS air bag control unit, SRS warning light, front impact sensors, driver's and passenger's (front) air bag modules, knee air bag module, side-airbag module, curtain air bag module, side impact sensors, seat belt pre-tensioners, clock spring, and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

GENERAL INFORMATION

M1372000100951

- The steering wheel has three spokes. All vehicles are equipped with SRS (Supplemental Restraint System).
- The steering column has a shock absorbing mechanism and a tilt steering mechanism.
- The steering system uses a vane oil pump with a fluid flow control system, so that steering effort varies with engine speed.



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SPECIFICATIONS

GENERAL SPECIFICATIONS

M1372000200356

Item		Specification
Power steering gear box	Type	Rack and pinion
	Stroke ratio (Rack stroke/Steering wheel maximum turning radius) mm/rev (in/rev)	45.58 (1.79)
Oil pump	Type	Vane type
	Displacement cm^3/rev (cu in/rev)	8.1 (0.49)
	Relief set pressure MPa (psi)	8.8 (1,276)

SERVICE SPECIFICATIONS

M1372000301099

Item		Standard value	Limit
Steering wheel free play mm (in)	With engine running	–	30 (1.2)
	With engine stopped	16.5 (0.6) or less	–

TSB Revision

Item		Standard value	Limit
Steering angle	Inside wheel	40° 50' ±1° 30'	–
	Outside wheel (reference)	33° 50'	–
Toe-in mm (in)		1 ±2 (0.04 ±0.09)	–
Tie rod end ball joint breakaway torque N· m (in-lb)		2.9 (26) or less	–
Tie rod swing resistance N (lb) [Tie rod swing torque N· m (in-lb)]		5 –18 (44 –80) [1.5 –4.9 (13.2 –43.4)]	–
Engine idle speed r/min		700 ±50	–
Stationary steering effort N (lb) [Fluctuation allowance N (lb)]		29 (6.5) or less [5.9 (1.33) or less]	–
Oil pump pressure MPa (psi)	Oil pump relief pressure	8.8 –9.5 (1,276 –1,378)	–
	Pressure under no-load conditions	0.2 –0.7 (29 –101)	–
	Steering gear retention hydraulic pressure	8.8 –9.5 (1,276 –1,378)	–
Steering gear total pinion torque N· m (in-lb) [Change in torque N· m (in-lb)]		1.0 –2.0 (0.8 –1.6) [0.4 (3.5) or less]	–
Opening dimension of special tool MB991561 mm (in)		2.9 (0.11)	–
Band crimped width mm (in)		2.4 –2.8 (0.09 –0.11)	–

LUBRICANTS

M1372000400662

Item		Specified lubricant	Quantity dm^3 (qt)
Power steering fluid		Genuine Mitsubishi Power Steering Fluid	1.0 (1.06)
Steering gear	Bearing	Genuine Mitsubishi Power Steering Fluid	As required
	O-ring and seal ring		
	Oil seal		
	Special tool (MB991213)		
	Pinion and valve assembly seal ring part		
	Bellows	Silicon grease	As required
Oil pump	Friction surface of rotor vane, cam ring and pump cover	Genuine Mitsubishi Power Steering Fluid	As required
	O-ring		

SEALANTS

M1372000500700

Item		Specified sealant
Steering gear	Bellows	3M™ AAD Part No.8663 or equivalent

POWER STEERING DIAGNOSIS

INTRODUCTION TO POWER STEERING DIAGNOSIS

M1372008500254

Hydraulic power steering is used for all vehicles. Faults in the power steering can include excessive play of the steering wheel, difficult steering wheel operation, noise, vibration, and oil leaks, etc. Possible causes of these faults can include defects in the gear box, oil pump or steering linkage.

POWER STEERING DIAGNOSIS TROUBLESHOOTING STRATEGY

M1372007300291

Use these steps to plan your diagnostic strategy. If you follow them carefully, you will be sure that you have exhausted most of the possible ways to find a power steering fault.

1. Gather information from the customer.
2. Verify that the condition described by the customer exists.
3. Find the malfunction by following the Symptom Chart.
4. Verify malfunction is eliminated.

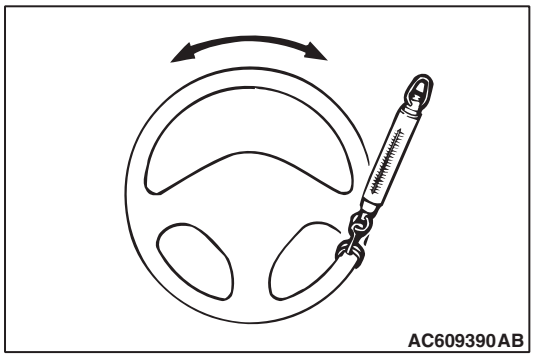
SYMPTOM CHART

M1372007600366

Symptom	Inspection procedure	Reference page
Excessive play of steering wheel	1	P.37-5
Difficult steering wheel operation (insufficient power assist)	2	P.37-6
Rattling noise	3	P.37-7
Shrill noise	4	P.37-8
Squealing noise	5	P.37-8
Hissing noise	6	P.37-8
Droning noise	7	P.37-9
Squeaking noise	8	P.37-9
Vibration	9	P.37-10
Oil leakage from hose connection	10	P.37-10
Oil leakage from hose assembly	11	P.37-11
Oil leakage from oil reservoir	12	P.37-11
Oil leakage from oil pump	13	P.37-11
Oil leakage from steering gear	14	P.37-11

SYMPTOM PROCEDURES

INSPECTION PROCEDURE 1: Excessive Play of Steering Wheel



DIAGNOSIS

STEP 1. Check for looseness at the steering shaft coupling section and at the steering wheel linkage.

Q: Is there any looseness?

YES : Repair or replace the part. Then go to Step 3.
NO : Go to Step 2.

STEP 2. Check the steering wheel free play.

(1) With the engine running (hydraulic operation), set the front wheels straight ahead.
(2) Measure the play on the steering wheel circumference before the wheels start to move when slightly moving the steering wheel in both directions.

Limit: 30 mm (1.2 inch)

(3) If the free play exceeds the limit value, set the steering wheel straight ahead with the engine stopped. Load approximately 5 N (1.1 pound) towards the steering circumference and check the play.

Standard value (steering wheel play with engine stopped): 16.5 mm (0.6 inch) or less

Q: Does the play exceed the standard value?

YES : Remove the steering gear box (Refer to P.37-29) and check the total pinion torque (Refer to P.37-29). Then go to Step 3.
NO : Go to Step 3.

STEP 3. Check the steering wheel play.

Verify that the steering wheel play is not excessive.

Q: Is the steering wheel play excessive?

YES : Repeat from Step 1.
NO : The procedure is complete.

INSPECTION PROCEDURE 2: Difficult Steering Wheel Operation (Insufficient Power Assist)

DIAGNOSIS

STEP 1. Check the power steering oil pump drive belt tension.

Refer to GROUP 00, Maintenance Service –Drive Belts P.00-59.

Q: Is the power steering oil pump drive belt tension within the standard value?

YES : Go to Step 2.
NO : Adjust the tension (Refer to GROUP 00, Maintenance Service –Drive Belts P.00-59). Then go to Step 10.

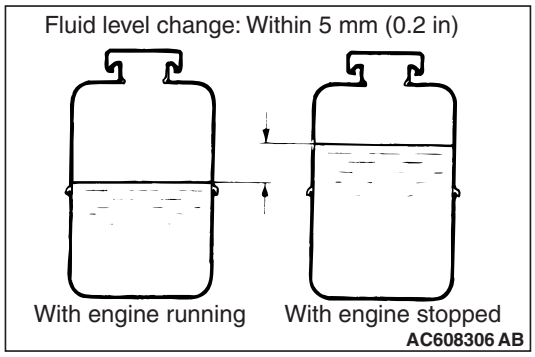
STEP 2. Check the drive belt for damage.

Q: Is the drive belt damaged?

YES : Replace the drive belt. Then go to Step 10.
NO : Go to Step 3.

STEP 3. Check the fluid level.

(1) Park the vehicle on a flat, level surface, and then start the engine.
(2) Turn the steering wheel several times to raise the temperature of the fluid to approximately 50 –60° C (122 – 140° F).
(3) With the engine running, turn the wheel all the way to the left and right several times.
(4) Check the fluid in the oil reservoir for foaming or milkiness. Check the difference of the fluid level when the engine is stopped, and while it is running. If the change of the fluid level is 5 mm (0.2 inch) or more, bleed the air from the system (Refer to P.37-17).



Q: Is the fluid foamy?

YES : Go to Step 4.
NO : Go to Step 10.

STEP 4. Check for entry of air.

Q: Has air entered?

YES : Bleed the air (Refer to P.37-17). Then go to Step 10 .
NO : Go to Step 5.

STEP 5. Check each hose for crushing or twisting.

Q: Is any hose crushed or twisted?

YES : Repair or replace the hose. Then go to Step 10.
NO : Go to Step 6.

STEP 6. Check for oil leaks.

Q: Are there oil leaks?

YES : Repair it. Then go to Step 10.
NO : Go to Step 7.

STEP 7. Check the wheel alignment (camber and caster).
Refer to GROUP 33, On-vehicle Service –Front Wheel Alignment Check and Adjustment P.33-8.

Q: Is the alignment incorrect?

YES : Repair it. Then go to Step 10.
NO : Go to Step 8.

STEP 8. Check the gear box rack piston seal for damage.

Q: Is there damage?

YES : Replace it. Then go to Step 10.
NO : Go to Step 9.

STEP 9. Check for excessive tie rod end ball joint breakaway torque.
Refer to P.37-14.

Q: Is there fault?

YES : Replace the part. Then go to Step 10.
NO : Go to Step 10.

STEP 10. Check the steering wheel operation.
Verify that the steering wheel operation is not difficult.

Q: Is the steering wheel operation difficult?

YES : Repeat from Step 1.
NO : The procedure is complete.

INSPECTION PROCEDURE 3: Rattling Noise

DIAGNOSIS

STEP 1. Check for proper oil pump and steering gear installation.

Q: Is the oil pump and the steering gear installation correct?

YES : Go to Step 2.
NO : Repair it. Then go to Step 4.

STEP 2. Check for interference of other parts with the steering column and the power steering hoses.

Q: Is there interference?

YES : Correct the interference. Then go to Step 4.
NO : Go to Step 3.

STEP 3. Check for noise from inside the oil pump or the steering gear.

Q: Is there noise?

YES : Replace the part. Then go to Step 4.
NO : Go to Step 4.

STEP 4. Check for rattling noise.
Confirm that no noise is generated.

Q: Is there noise?

YES : Repeat from Step 1.
NO : The procedure is complete.

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INSPECTION PROCEDURE 4: Shrill Noise

DIAGNOSIS

STEP 1. Check for entry of air.

Q: Is the power steering fluid foamy?
YES : Bleed the air (Refer to P.37-17). Then go to Step 3.
NO : Go to Step 2.

STEP 2. Check for seizure in the oil pump.

Q: Is there seizure?
YES : Replace the part. Then go to Step 3.
NO : Go to Step 3.

STEP 3. Retest the system.
Confirm that no noise is generated.

Q: Is there noise?
YES : Repeat from Step 1.
NO : The procedure is complete.

INSPECTION PROCEDURE 5: Squealing Noise

DIAGNOSIS

STEP 1. Check the drive belt tension.
Refer to GROUP 00, Maintenance Service –Drive Belts P.00-59.

Q: Is the drive belt tension incorrect?
YES : Adjust the belt tension (Refer to GROUP 00, Maintenance Service –Drive Belts P.00-59). Then go to Step 3.
NO : Go to Step 2.

STEP 2. Check for seizure in the oil pump.

Q: Is there seizure?
YES : Replace the part. Then go to Step 3.
NO : Go to Step 3.

STEP 3. Retest the system.
Confirm that no noise is generated.

Q: Is there noise?
YES : Repeat from Step 1.
NO : The procedure is complete.

INSPECTION PROCEDURE 6: Hissing Noise

DIAGNOSIS

STEP 1. Check for entry of air.

Q: Is the power steering fluid foamy?
YES : Bleed the air (Refer to P.37-17). Then go to Step 4.
NO : Go to Step 2.

STEP 2. Check each hose for crushing or twisting.

Q: Is any hose crushed or twisted?
YES : Repair or replace the hose. Then go to Step 4.
NO : Go to Step 3.

STEP 3. Check the steering gear for damage.

Q: Is there damage?
YES : Repair or replace the part. Then go to Step 4.
NO : Go to Step 4.

STEP 4. Retest the system.
Confirm that no noise is generated.

Q: Is there noise?
YES : Repeat from Step 1.
NO : The procedure is complete.

INSPECTION PROCEDURE 7: Droning Noise

DIAGNOSIS

STEP 1. Check the oil pump or oil pump bracket installation.

Q: Is the oil pump or the oil pump bracket installation correct?
YES : Go to Step 2.
NO : Repair it. Then go to Step 3.

STEP 2. Check the oil pump for damage.

NOTE: If a slight "beat noise" is produced by the oil pump when the steering wheel is turned fully and held in that position, this is not a malfunction.

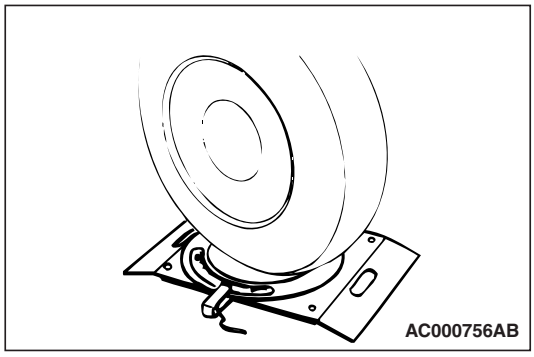
Q: Is there damage?
YES : Replace the oil pump. Then go to Step 3.
NO : Go to Step 3.

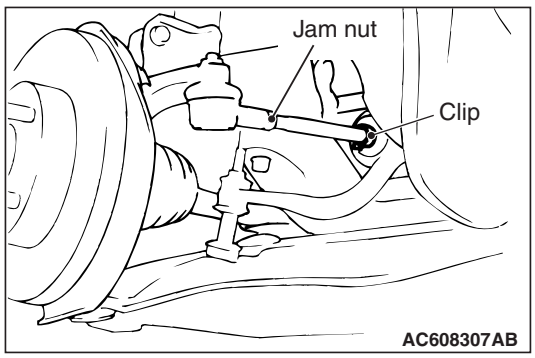
STEP 3. Retest the system.

Confirm that no noise is generated.

Q: Is there noise?
YES : Repeat from Step 1.
NO : The procedure is complete.

INSPECTION PROCEDURE 8: Squeaking Noise





DIAGNOSIS

STEP 1. Check for interference of the wheel and the vehicle body.

If interfering, adjust the steering angle.

(1) Place the front wheel on a turning radius gauge and measure the steering angle.

Standard value:

Item	Specification
Inside wheel	40° 50' ±1° 30'
Outside wheel (reference)	33° 50'

(2) If the steering angle is not within the standard value, adjust the toe-in.

Standard value: 1 ±2 mm (0.04 ±0.09 inch)

(3) Adjust the toe-in by undoing the clip and jam nut, and turning the left and right tie rod turnbuckles by the same amount (in opposite directions).

NOTE: The toe will move out as the left turnbuckle is turned toward the front of the vehicle and the right turnbuckle is turned toward the rear of the vehicle.

Q: Is the steering angle normal?
YES : Go to Step 2.
NO : Adjust the steering angle. Then go to Step 3.

STEP 2. Check the steering gear for damage.

Q: Is there damage?

YES : Repair or replace the part. Then go to Step 3.
NO : Go to Step 3.

STEP 3. Retest the system.
Confirm that no noise is generated.

Q: Is there noise?

YES : Repeat from Step 1.
NO : The procedure is complete.

INSPECTION PROCEDURE 9: Vibration

NOTE: A slight vibration may be felt when the stationary steering effort is made due to the condition of the road surface. To check whether the vibration actually exists or not, test-drive the vehicle on a dry concrete or asphalt surface. A very slight amount of vibration is not a malfunction.

DIAGNOSIS

STEP 1. Check for entry of air.

Q: Is the power steering fluid foamy?

YES : Bleed the air (Refer to P.37-17). Then go to Step 3.
NO : Go to Step 2.

STEP 2. Check the steering gear for damage.

Q: Is there damage?

YES : Repair or replace the part. Then go to Step 3.
NO : Go to Step 3.

STEP 3. Retest the system.
Confirm that no vibration is generated.

Q: Is there vibration?

YES : Repeat from Step 1.
NO : The procedure is complete.

INSPECTION PROCEDURE 10: Oil Leakage from Hose Connection

DIAGNOSIS

STEP 1. Check for loosening of the return tube flare nut.

Q: Is the flare nut loose?

YES : Tighten it to 15 ±3 N· m (11 ±2 ft-lb). Then go to Step 3.
NO : Go to Step 2.

STEP 2. Check the hose connection and the clamp installation.

Q: Are they correct?

YES : Go to Step 3.
NO : Repair or replace the part. Then go to Step 3.

STEP 3. Retest the system.
Check that no oil is leaking.

Q: Is there oil leakage?

YES : Repeat from Step 1.
NO : The procedure is complete.

INSPECTION PROCEDURE 11: Oil Leakage from Hose Assembly

DIAGNOSIS

STEP 1. Check the hose for damage or clogging.

Q: Is the hose damaged or clogged?
YES : Repair or replace it. Then go to Step 2.
NO : Go to Step 2.

STEP 2. Retest the system.
Check that no oil is leaking.

Q: Is there oil leakage?
YES : Repeat from Step 1.
NO : The procedure is complete.

INSPECTION PROCEDURE 12: Oil Leakage from Oil Reservoir

DIAGNOSIS

STEP 1. Check the oil reservoir for damage.

Q: Is there damage?
YES : Repair or replace it. Then go to Step 3.
NO : Go to Step 2.

STEP 2. Check for overflowing.

Q: Is there oil overflowing from the reservoir?
YES : Adjust fluid level. Then go to Step 3.
NO : Go to Step 3.

STEP 3. Retest the system.

Q: Is there oil leakage?
YES : Repeat from to Step 1.
NO : The procedure is complete.

INSPECTION PROCEDURE 13: Oil Leakage from Oil Pump

DIAGNOSIS

STEP 1. Check the oil pump body for damage.

Q: Is there damage?
YES : Replace the part. Then go to Step 3.
NO : Go to Step 2.

STEP 2. Check the O-ring or oil seal for damage.

Q: Is there damage?
YES : Replace the part. Then go to Step 3.
NO : Go to Step 3.

STEP 3. Retest the system.
Check that no oil is leaking.

Q: Is there oil leakage?
YES : Repeat from Step 1.
NO : The procedure is complete.

INSPECTION PROCEDURE 14: Oil Leakage from Steering Gear

DIAGNOSIS

STEP 1. Check the steering gear housing for damage.

Q: Is there damage?
YES : Replace the part. Then go to Step 3.
NO : Go to Step 2.

STEP 2. Check the oil-ring or oil seal for damage.

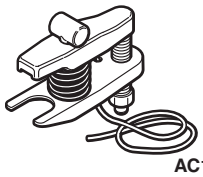
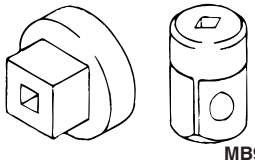
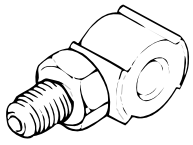
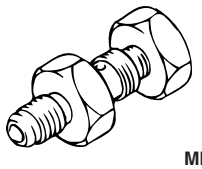
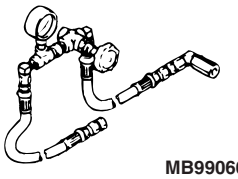
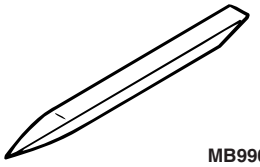
Q: Is there damage?
YES : Replace the part. Then go to Step 3.
NO : Go to Step 3.

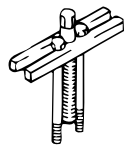
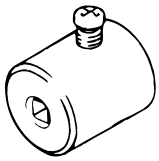
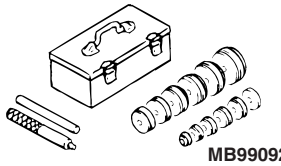
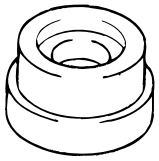
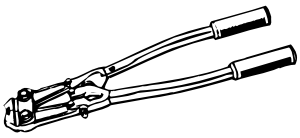
STEP 3. Retest the system.
Check that no oil is leaking.

Q: Is there oil leakage?
YES : Repeat from Step 1.
NO : The procedure is complete.

SPECIAL TOOLS

M1372000601001

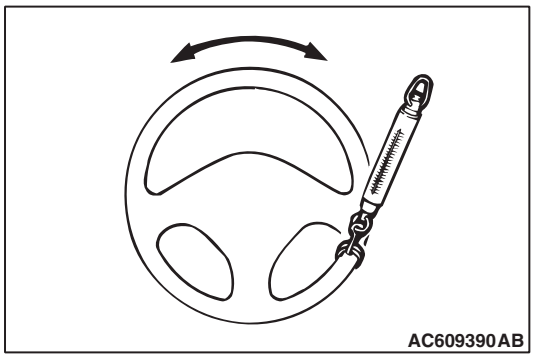
Tool	Tool number and name	Supersession	Application
 AC106827	MB991897 or MB992011 Ball joint remover	MB991113-01, MB990635-01 or General service tool	Knuckle and tie rod end ball joint disconnection *NOTE: Steering linkage puller (MB990635 or MB991113) is also available to disconnect knuckle and tie rod end ball joint.*
 MB990326	MB990326 Preload socket	General service tool	Tie rod end ball joint breakaway torque check
 MB991548	MB991548 Power steering oil pressure gauge adapter (Pump side)	MB991548-01	Oil pump pressure test
 MB991549	MB991549 Power steering oil pressure gauge adapter (Hose side)	MB991549-01	
 MB990662	MB990662 Power steering oil pressure gauge	MB990662-01	
 MB990784	MB990784 Ornament remover	General service tool	Cover removal

Tool	Tool number and name	Supersession	Application
 MB990803	MB990803 Steering wheel puller	General service tool	Steering wheel removal
 MB991006	MB990228 or MB991006 Preload socket	MB990228-01	Steering gear total pinion torque check
 MB990925	MB990925 Bearing and oil seal installer set	MB990925-01 or general service tool	• Oil seal and bearing installation • MB990927, MB990938, MB990939 (For details, refer to GROUP 26, Special Tools P.26-5).
 MB991203	MB991203 Oil seal and bearing installer	Tool not available	Oil seal and bearing installation
 MB991561	MB991561 Boot band crimping tool	MB991561	Bellows band installation

ON-VEHICLE SERVICE

STEERING WHEEL FREE PLAY CHECK

M1372001000719


AC609390AB

1. With the engine running (hydraulic pressure applied), position the front wheel in the straight ahead position.
2. Measure the side to side steering wheel play until the front wheels actually start moving while turning the steering wheel slightly in the left and right directions.

   Limit: 30 mm (1.2 inch)
3. If the steering wheel play exceeds the limit value, check the steering shaft joint or steering linkage for looseness, and replace or repair the faulty components if necessary.
4. If the steering wheel play still exceeds the limit value after Step 3 is performed, position the steering wheel in the straight ahead position, and then apply the force (approximately 5 N) in the circumferential direction.

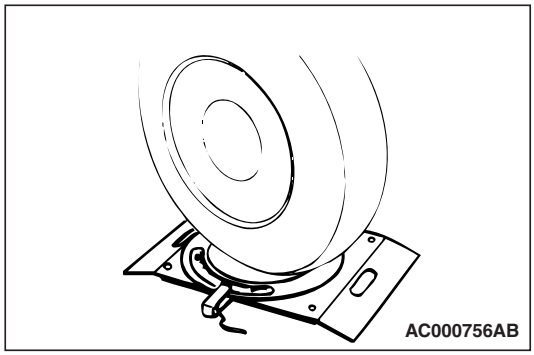
TSB Revision

Standard value (steering wheel play with the engine stopped): 16.5 mm (0.6 inch) or less

5. If the steering wheel play is outside the standard value after Step 4 is performed, remove the steering gear and linkage, and check and adjust the pinion total rotation torque. (Refer to P.37-29).

STEERING ANGLE CHECK

M1372001100976


AC000756AB

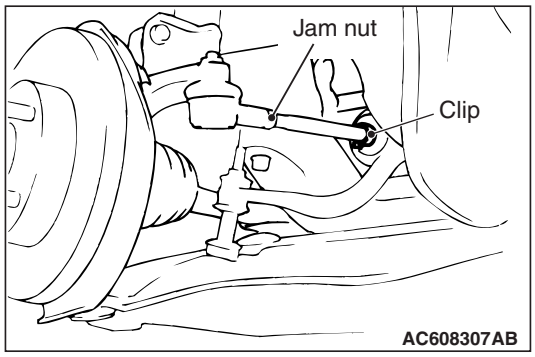
1. Place the front wheel on a turning radius gauge and measure the steering angle.

Standard value:

Item	Specifications
Inside wheel	40° 50' ±1° 30'
Outside wheel (reference)	33° 50'

2. If the steering angle is not within the standard value, adjust the toe-in as follows.

Standard value: 1 ±2 mm (0.04 ±0.09 inch)



3. Loosen the jam nut, and unclip the bellows.
4. Adjust the toe-in by turning the left and right tie rod turnbuckles by the same amount (in opposite directions).

NOTE: The toe will move out as the left turnbuckle is turned toward the front of the vehicle and the right turnbuckle is turned toward the rear of the vehicle.

5. Tighten the jam nut to the specified torque, and tighten the bellows by the clip.

Tightening torque: 51 ±2 N· m (37 ±2 ft-lb)

6. Recheck the steering angle.

TIE ROD END BALL JOINT BREAKAWAY TORQUE CHECK

M1372001500673

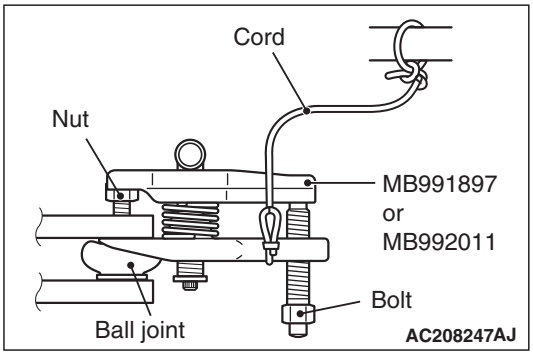
Required Special Tools:

- MB990326: Preload Socket
- MB991897 or MB992011: Ball Joint Remover

⚠ CAUTION

- **Loosen the self-locking nut (tie-rod end connection) from the ball joint, but do not remove here. Use the special tool.**
- **To prevent the special tool from dropping off, suspend it with a rope.**

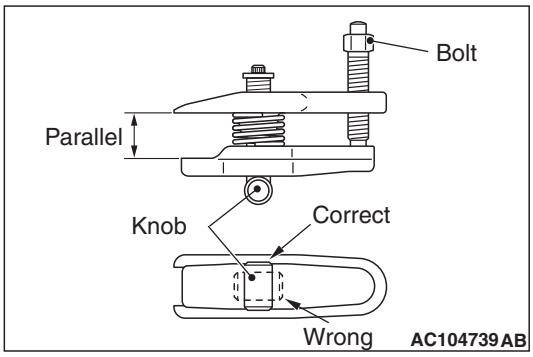
1. Install special tool MB991897 or MB992011 as shown in the figure.



2. Turn the bolt and knob to make the special tool jaws parallel, then hand-tighten the bolt. After tightening, check that the jaws are still parallel.

   NOTE: To adjust the special tool jaws to be parallel, set the orientation of the knob as shown in the figure.

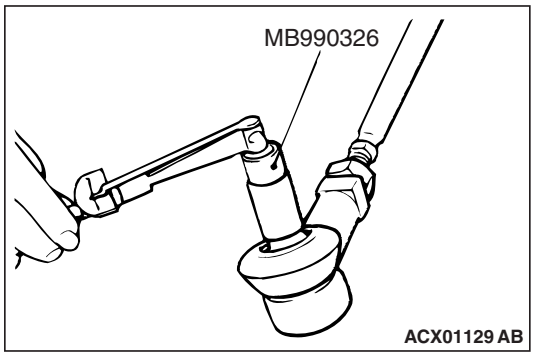
3. Unscrew the bolt to disconnect the ball joint.



4. Move the ball joint stud several times and install the nut on the stud. Using the special tool MB990326, measure the ball joint breakaway torque.

   Standard value: 2.9 N· m(26 in-lb) or less

5. If the breakaway torque exceeds the standard value, replace the tie rod end.
6. If the breakaway torque is under the standard value, check the ball joint for end play or ratcheting. If no end play or ratcheting, the ball joint can be re-used.



⚠ CAUTION

Always use a new ball joint nut as it is a self-locking nut.

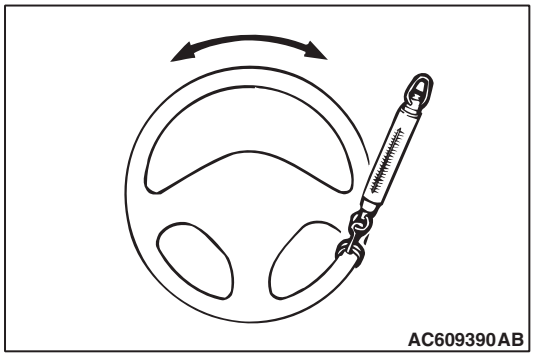
7. Install the tie rod end to the knuckle, then tighten a new self-locking nut to the specified torque.

   Tightening torque: 25 ±5 N· m (19 ±3 ft-lb)

STATIONARY STEERING EFFORT CHECK

M1372001700815

1. Park the vehicle on a level paved road, position the steering wheel in the straight ahead position.
2. Start the engine, and maintain the engine speed at 700 ±50 r/min.

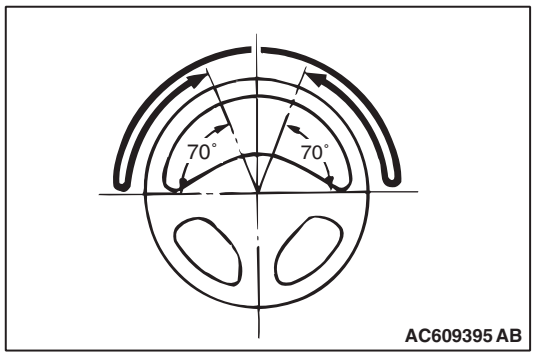

AC609390AB

3. Position the spring scale on the circumference of the steering wheel, and measure the steering force at the time when the steering wheel is turned to right or left side (within the range of one and a half turns) from the center position.
   Standard value:
   Steering force: 29 (6.5 lb) N or less
   Fluctuation band: 5.9 (1.33 lb) N or less
4. If not within the standard value, check and adjust the suspected components.

STEERING WHEEL RETURN TO CENTER CHECK

M1372001800577

Conduct a road test:



AC609395AB

1. Make both gradual and sudden turns and check the steering wheel return.
2. At a vehicle speed of approximately 35 km/h (22 mph), turn the steering wheel 90 degrees, hold a few seconds, then release. If the steering wheel then returns 70 degrees or more, the return can be judged satisfactory.
   NOTE: There will be a momentary feeling or "heaviness" when the wheel is turned quickly, but this is not abnormal (Oil pump discharge amount is especially apt to be insufficient during idling).

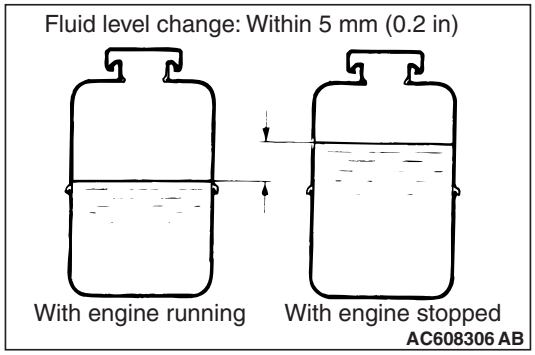
DRIVE BELT TENSION CHECK

M1372001900671

Refer to GROUP 00, Maintenance Service –Drive Belts P.00-59.

FLUID LEVEL CHECK

M1372002000552

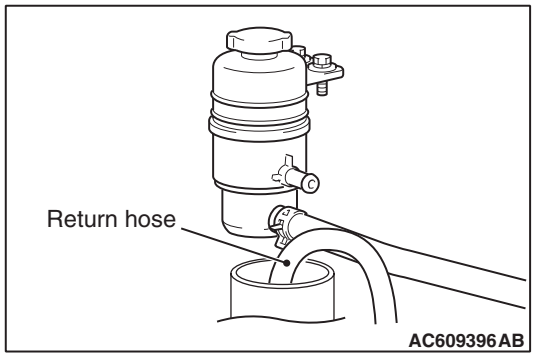


AC608306AB

1. Park the vehicle on a flat, level surface.
2. Start the engine, and then turn the steering wheel several times to raise the temperature of the fluid to approximately 50 –60° C (122 –140° F).
3. With the engine running, turn the wheel all the way to the left and right several times.
4. Check the fluid in the oil reservoir for foaming or milkiness. Check the difference of the fluid level when the engine is stopped, and while it is running. If the change of the fluid level is 5 mm (0.2 inch) or more, air bleeding should be done.

FLUID REPLACEMENT

M1372002100689



1. Raise and support the front wheels.
2. Disconnect the return hose connection, and then connect a vinyl hose to the return hose, and drain the fluid into a container.
3. Disconnect the ignition coil connectors (Refer to GROUP 16, Ignition Coil P.16-39).
4. While operating the starter motor intermittently, turn the steering wheel all the way to the left and right several times to drain all of the fluid.
5. Connect the return hose securely, and then secure with the clip.
6. Fill the oil reservoir with GENUINE MITSUBISHI POWER STEERING FLUID to the lower position of the filler, and then bleed the air.

POWER STEERING SYSTEM AIR BLEEDING

M1372002200686

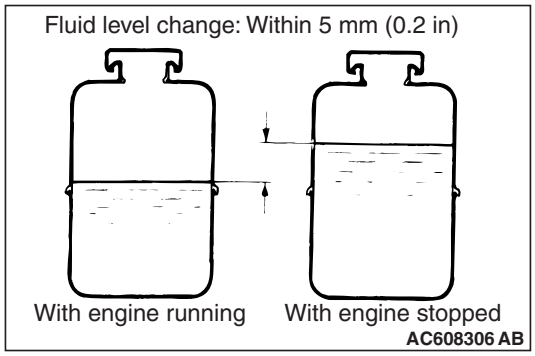
Perform air bleeding procedure as necessary after replacing the steering gear or the steering fluid lines.

1. Raise and support the front wheels.
2. Disconnect the ignition coil connectors (Refer to GROUP 16, Ignition Coil P.16-39).

⚠ CAUTION

Perform air bleeding only while cranking the engine. If air bleeding is performed while the engine is running, air could enter the fluid. During air bleeding, refill the steering fluid supply so that the level never falls below the lower mark on the dipstick.

3. Turn the steering wheel all the way to the left and right five or six times while using the starter motor to crank the engine intermittently several times (for 15 to 20 seconds).
4. Connect the ignition coil connectors (Refer to GROUP 16, Ignition Coil P.16-39).
5. Start the engine (idling).
6. Turn the steering wheel to the left and right until there are no air bubbles in the oil reservoir.
7. Confirm that the fluid is not milky, and that the level is between the high and low dipstick marks.
8. Confirm that there is very little change in the fluid level when the steering wheel is turned left and right.



⚠ CAUTION

If the fluid level rises suddenly after the engine is stopped, the air has not been completely bled. If air bleeding is not complete, there will be abnormal noises from the pump and the flow-control valve, and this condition could cause reduce the life of the power steering components.

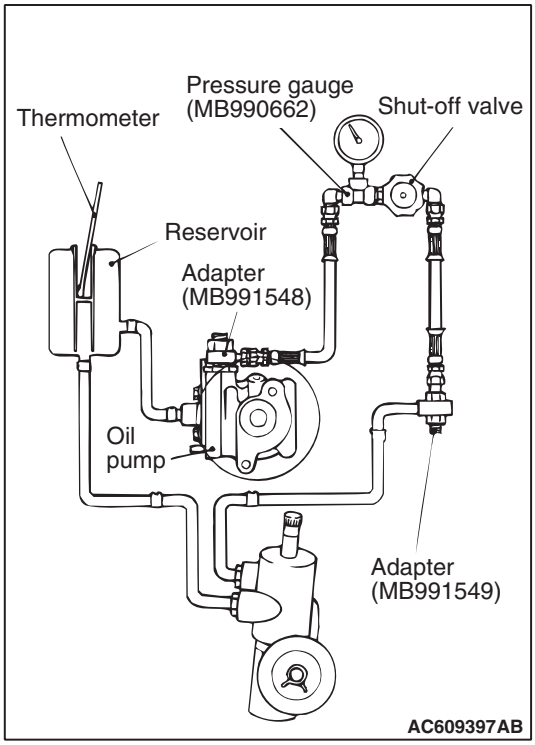
9. Confirm that the change in the fluid level is no more than 5 mm (0.2 inch) when the engine is stopped and when it is running.
10. If the change of the fluid level is 5 mm (0.2 inch) or more, the air has not been completely bled from the system. The air bleeding procedure must be repeated.

OIL PUMP PRESSURE TEST

M1372002300650

Required Special Tools:

- MB990662: Power Steering Oil Pressure Gauge
- MB991548: Power Steering Oil Pressure Gauge Adapter (Pump Side)
- MB991549: Power Steering Oil Pressure Gauge Adapter (Hose Side)



1. Disconnect the pressure hose from the oil pump, and then connect the special tools MB991548, MB990662 and MB991549.
2. Bleed air, then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50 –60° C (122 –140° F).
3. Start the engine and idle it at 700 ±50 r/min.

⚠ CAUTION

The pressure gauge shut-off valve must not remain closed for more than 10 seconds.

4. Fully close the shut-off valve of the pressure gauge and measure the oil pump relief pressure to confirm that it is within the standard value range. Open it again immediately after checking the pressure.

   Standard value: 8.8 –9.5 MPa (1,276 –1,378 psi)

5. If it is not within the standard value, replace the oil pump.
6. Check whether or not the hydraulic pressure is the standard value when no-load conditions are created by fully opening the shut-off valve of the pressure gauge.

   Standard value: 0.2 –0.7 MPa (29 –101 psi)

7. If it is not within the standard value, the probable cause is a malfunction of the oil line or steering gear, so check these parts and repair as necessary.

8. Turn the steering wheel all the way to the left or right; then check whether or not the retention hydraulic pressure is the standard value.

   Standard value: 8.8 –9.5 MPa (1,276 –1,378 psi)

9. If not the standard value, overhaul the steering gear. Remeasure fluid pressure.
10. Remove the special tools MB991548, MB990662 and MB991549, and then tighten the pressure hose to the specified torque.

    Tightening torque: 57 ±7 N· m (42 ±5 ft-lb)

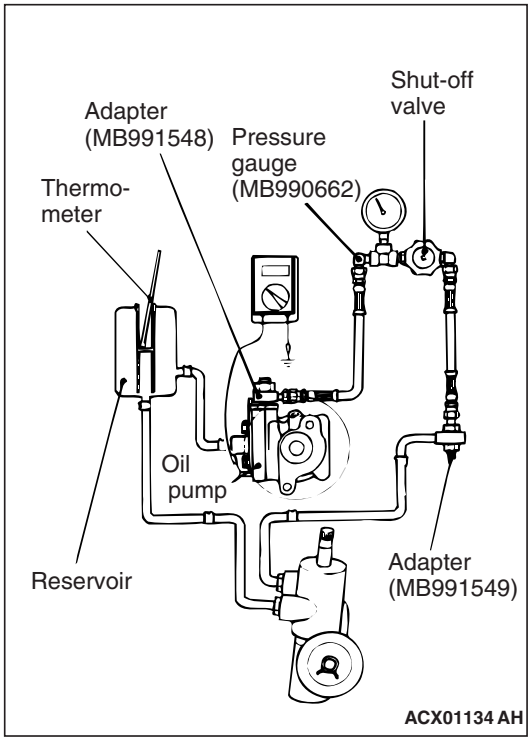
11. Bleed the system (Refer to P.37-17).

POWER STEERING PRESSURE SWITCH CHECK

M1372007200584

Required Special Tools:

- MB990662: Power Steering Oil Pressure Gauge
- MB991548: Power Steering Oil Pressure Gauge Adapter (Pump Side)
- MB991549: Power Steering Oil Pressure Gauge Adapter (Hose Side)



1. Disconnect the pressure hose from the oil pump, and then connect the special tools MB991548, MB990662 and MB991549.
2. Bleed air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50 –60° C (122 –140° F).
3. The engine should be idling.
4. Disconnect the connector for the oil pressure switch, and place an ohmmeter at the switch.
5. Gradually close the shut-off valve of the pressure gauge and increase the hydraulic pressure, then check whether or not the hydraulic pressure that activates the switch is the standard value.

   Standard value: 8.8 –9.5 MPa (1,276 –1,378 psi)

6. Gradually open the shut-off valve and reduce the hydraulic pressure; then check whether or not the hydraulic pressure that deactivates the switch is the standard value.

   Standard value: 8.8 –9.5 MPa (1,276 –1,378 psi)

7. Remove special tools MB991548, MB990662 and MB991549, connect the pressure hose to the oil pump, and then tighten the eye bolt to the specified torque.

   Tightening torque: 57 ±7 N· m (42 ±5 ft-lb)

8. Bleed the system. (Refer to P.37-17).

TIE ROD END BALL JOINT DUST COVER CHECK

M1372008600563

1. Using your fingers, press the dust cover to check for cracks or damage.
2. If there are any cracks in the dust cover or it is damaged, replace the tie-rod end.

   NOTE: If the dust cover has a crack or damage, the ball joint could be damaged.

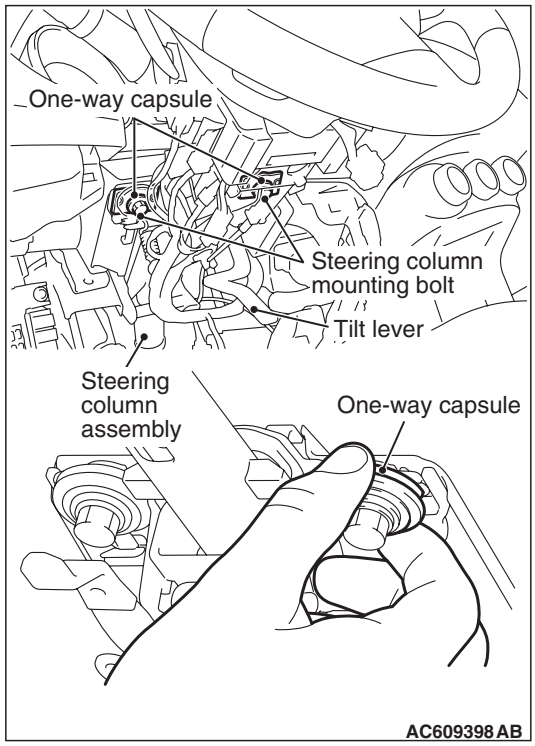
STEERING COLUMN SHAFT ASSEMBLY SHOCK ABSORBING MECHANISM CHECK

M1372013500487

⚠ ***WARNING***

- ***If the vehicle continues to be driven after the collision absorbing mechanism has operated, the steering column shaft may be damaged while it is in use.***
- ***If there is a slack in the mounting base, do not attempt to repair it. Replace the steering column shaft assembly.***

If a collision accident occurs or severe impact is applied on the steering wheel, the collision energy absorbing mechanism may have operated. Once the mechanism has operated, it will be inoperative even if it has suffered no apparent damage. Determine if the steering column shaft can be reused by the following procedure. If the collision energy absorbing mechanism has already operated, replace the steering shaft assembly. If any excessive radial freeplay on the steering wheel is found with the tilt lever in the lock position, always inspect the steering shaft assembly.



Inspection procedure:

1. Remove the lower and upper column covers.

⚠ **CAUTION**

After inspection, do not release the tilt lever until the steering shaft assembly has been installed.

2. Ensure that the tilt lever is in the lock position.
3. Loosen the two upper steering column mounting bolts by two turns.
4. Hold the one-way capsules as shown, and then try to rock them. If there is a slack in either of the capsules, replace the steering column shaft assembly.

   Reference:

   The mounting base is fixed to the column bracket with the ribet. Before the collision energy absorbing mechanism operates, the column bracket is secured to the mounting base. After operation, the ribet will break off causing a slack.

⚠ CAUTION

- **Be careful that nothing is pinched between the mounting base and the body.**
- **After inspection, do not release the tilt lever until the steering shaft assembly has been installed.**

5. After inspection, if there is no fault, tighten the two steering column upper side mounting bolts (2 bolts) to the specified torque.

Tightening torque: 12 ±3 N· m (102 ±26 in-lb)

STEERING WHEEL

REMOVAL AND INSTALLATION

M1372011400837

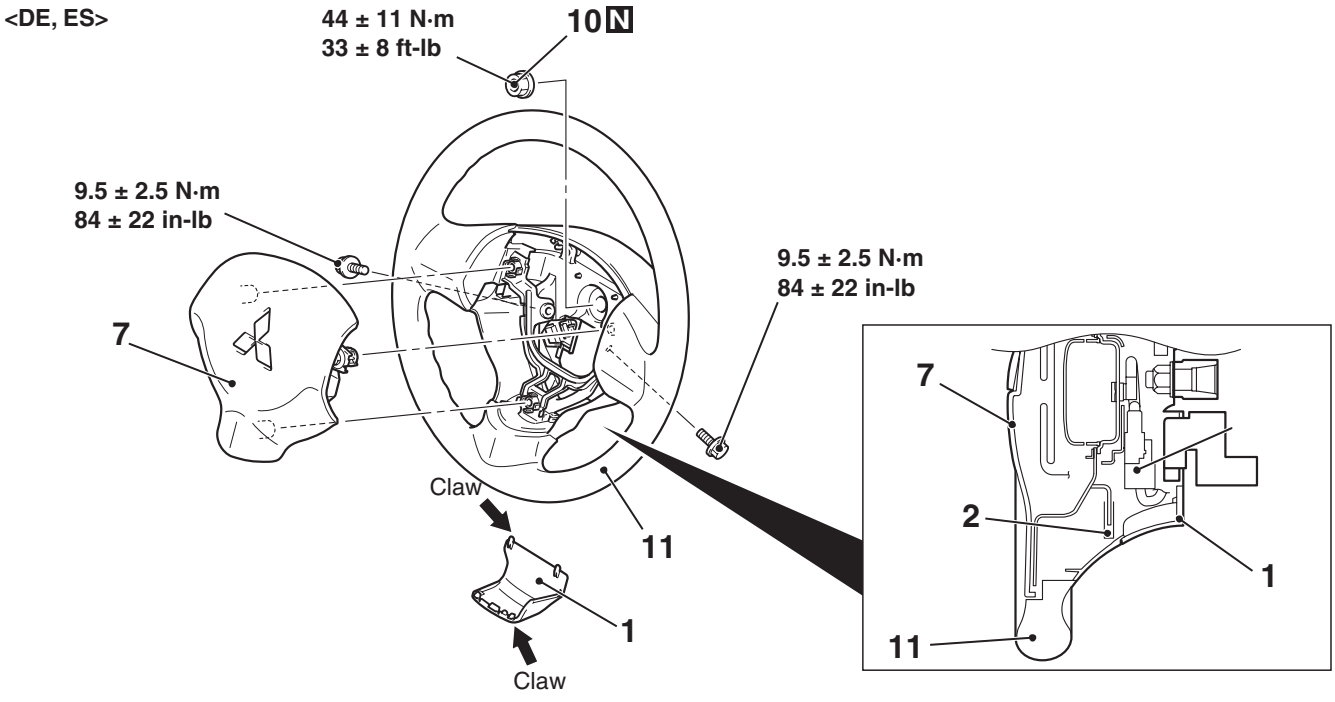
⚠ WARNING

Before removing the steering wheel and air bag module assembly, refer to GROUP 52B, Service Precautions P.52B-24 and Air Bag Module and Clock Spring P.52B-367.

⚠ WARNING

When removing and installing the steering wheel, do not let it bump against the air bag module.

Post-installation Operation
- Checking Steering Wheel Position with Wheels Straight Ahead (Refer to).



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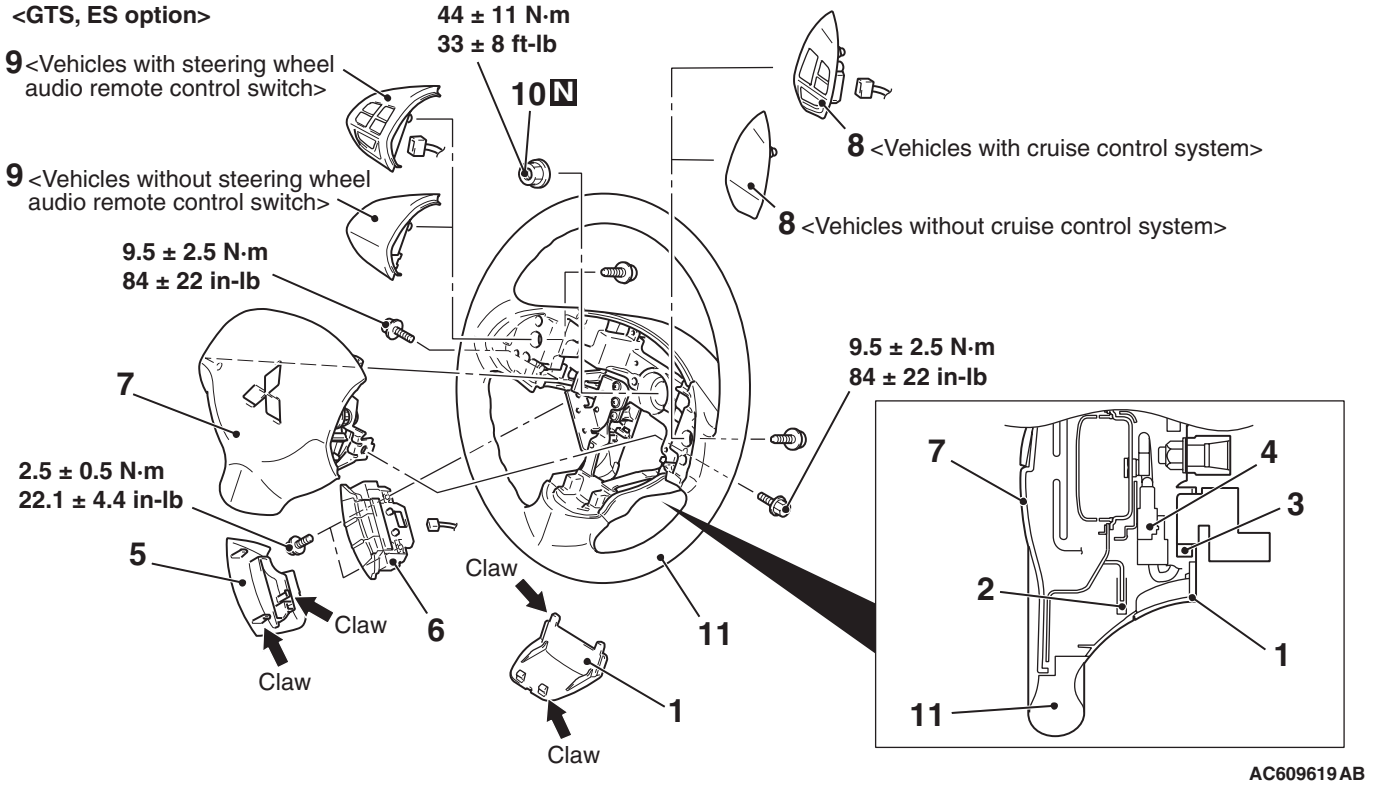


Removal steps

<<A>> >>B<< 1. Cover
>>B<< 2. Horn connector connection
>>B<< 3. Audio control switch connector connection <Vehicles with audio control switch>
<<B>> >>B<< 4. Air bag module connector connection
5. Steering wheel voice control cover
6. Steering wheel voice control switch
<<C>> 7. Air bag module

Removal steps (Continued)

8. Bezel cover or Cruise control switch
9. Bezel cover or Steering wheel audio remote control switch
10. Self-locking nut
<<D>> >>A<< 11. Steering wheel assembly

Required Special Tools:

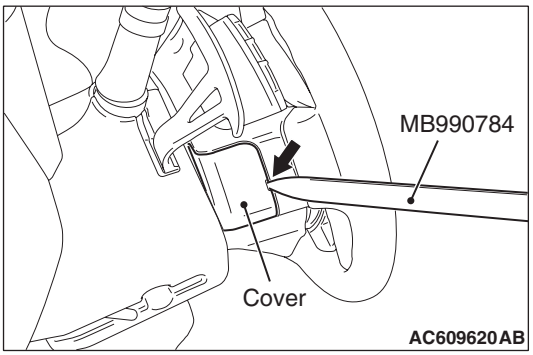
- MB990784: Ornament Remover
- MB990803: Steering wheel puller

REMOVAL SERVICE POINTS

<<A>> COVER REMOVAL

Insert the special tool MB990784 at the indicated position to remove the cover.

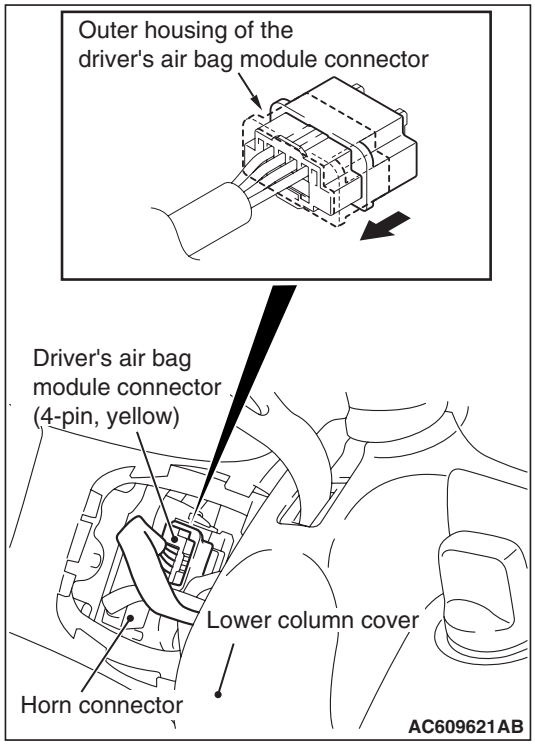
NOTE: The special tool MB990784 can be inserted through the notch behind the area shown.



TSB Revision

<<B>> AIR BAG MODULE CONNECTOR CONNECTION REMOVAL

Slide the outer housing of the driver's air bag module connector in the arrow direction shown and disconnect the connector.


Outer housing of the driver's air bag module connector
Driver's air bag module connector (4-pin, yellow)
Lower column cover
Horn connector
AC609621AB

<<C>> AIR BAG MODULE REMOVAL

⚠ CAUTION

- **Never use an electric tester to diagnose the air bag module circuit. Never attempt to disassemble the air bag module.**
- **Be sure to store removed air bag module in a clean and dry place with pad surface facing upward.**

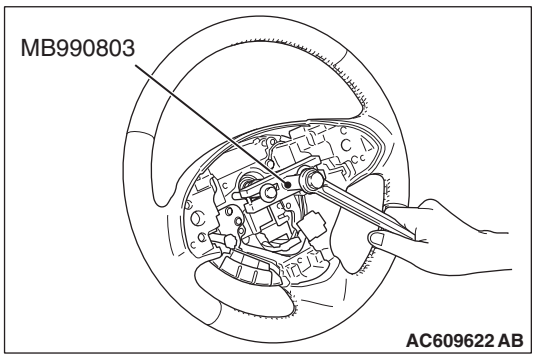
<<D>> STEERING WHEEL ASSEMBLY REMOVAL

1. Position the steering wheel in a straight ahead position.

⚠ CAUTION

- **Use the special tool to remove the steering wheel since the steering column collision adsorbing mechanism may be damaged.**

2. Use special tool MB990803 to remove the steering wheel.



INSTALLATION SERVICE POINTS

>>A<< STEERING WHEEL ASSEMBLY INSTALLATION

After centering the clock spring (Refer to 52B –Air bag module clock spring), install the steering wheel assembly.

>>B<< AIR BAG MODULE CONNECTOR CONNECTION/AUDIO CONTROL SWITCH CONNECTOR CONNECTION/HORN CONNECTOR CONNECTION INSTALLATION

Connect the connector securely and route the harnesses not to lie off the cover hole.

STEERING COLUMN SHAFT ASSEMBLY

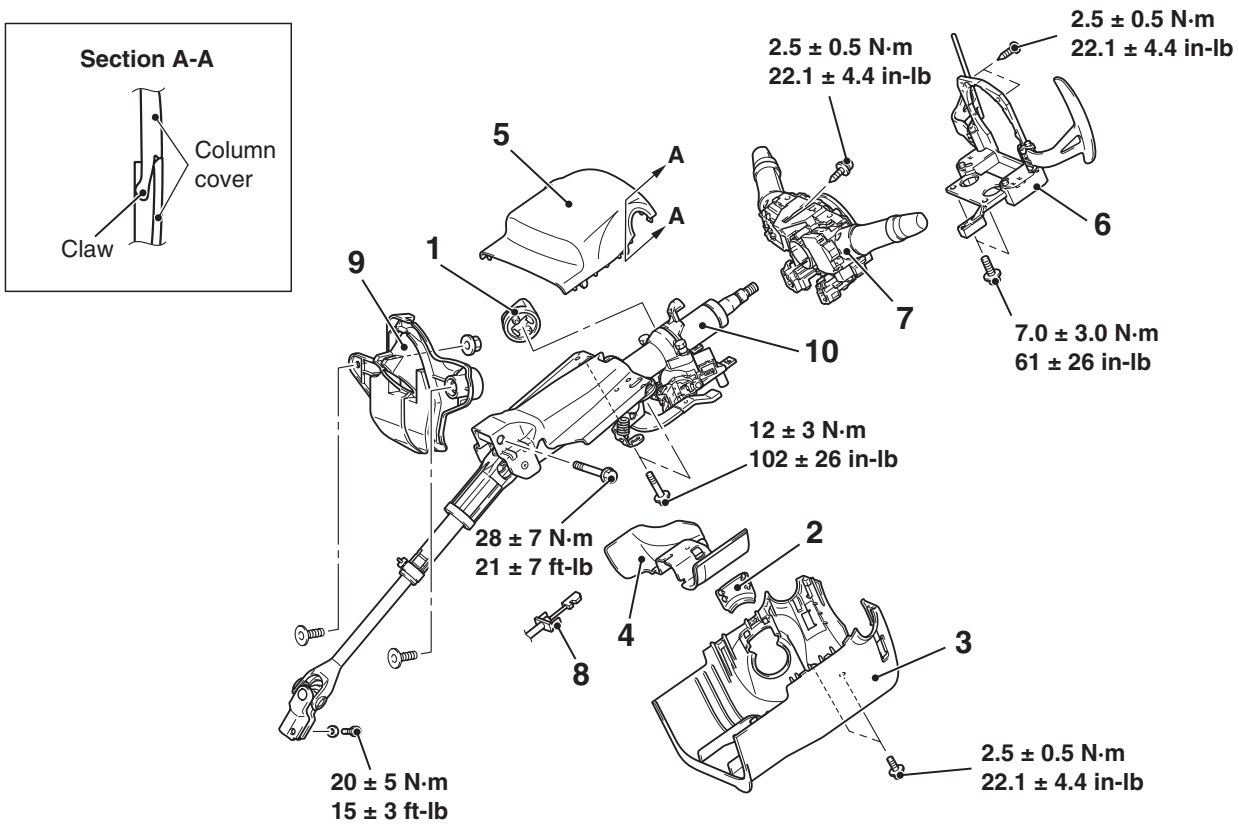
REMOVAL AND INSTALLATION

M1372011500737

⚠ WARNING

Before removing the steering wheel , air bag module assembly and Knee Air Bag Module refer to GROUP 52B, Service Precautions P.52B-24, Air Bag Module(s) and Clock Spring P.52B-367 and Knee Air Bag Module P.52B-378.

Pre-removal Operation	Post-installation Operation
• Steering Wheel Assembly Removal (Refer to P.37-21). • Instrument panel cover lower Removal (Refer to GROUP 52A –Instrument Panel P.52A-7). • Knee Air Bag Module Removal (Refer to GROUP 52B – Knee Air Bag Module P.52B-378). • Front Floor Console and Console Side Panel Removal (Refer to GROUP 52A –Front Floor Console P.52A-2).	• Front Floor Console and Console Side Panel Installation (Refer to GROUP 52A –Front Floor Console P.52A-2). • Knee Air Bag Module Installation (Refer to GROUP 52B – Knee Air Bag Module P.52B-378). • Instrument panel cover lower Installation (Refer to GROUP 52A –Instrument Panel P.52A-7). • Steering Wheel Assembly Installation (Refer to P.37-21).



AC609623 AB

Removal steps

<<A>>
1. Knob cap <Vehicles with KOS>
2. Ignition key cover
3. Steering column lower cover
4. Steering column protector
5. Steering column upper cover
6. Paddle shift assembly <GTS (Vehicles with CVT)>

Removal steps (Continued)

7. Clock spring and column switch assembly (Refer to 52B –Air bag module(s) and clock spring).
8. Key interlock cable (Refer to 23A –CVT Key interlock and shiftlock mechanisms).
9. Steering shaft cover

<<B>>
<<C>> >>A<<
10. Steering column shaft assembly

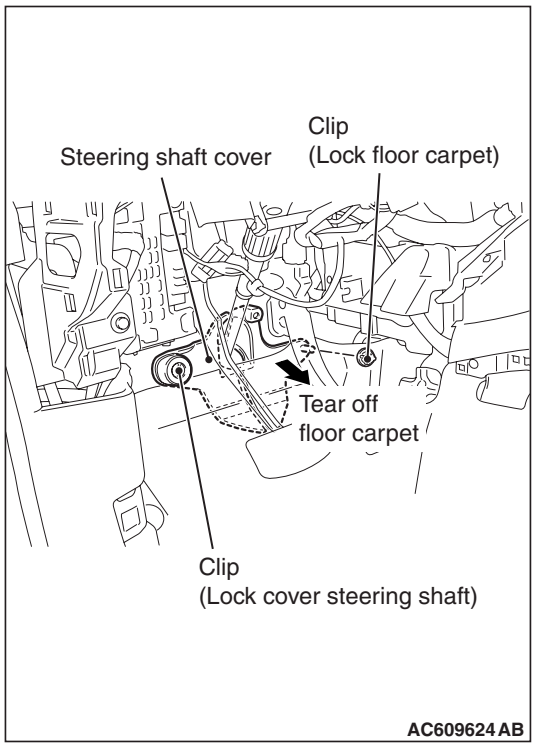
TSB Revision

REMOVAL SERVICE POINTS

<<A>> KNOB CAP REMOVAL

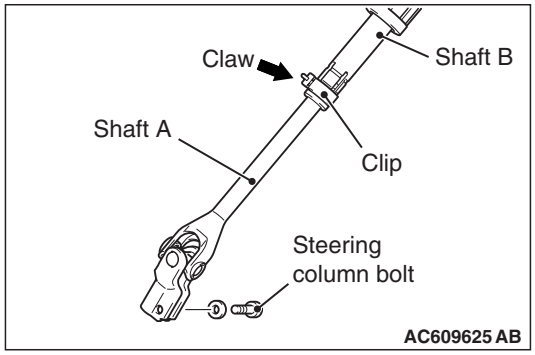
Remove the knob cap while pressing the two projections.

<<B>> STEERING SHAFT COVER REMOVAL

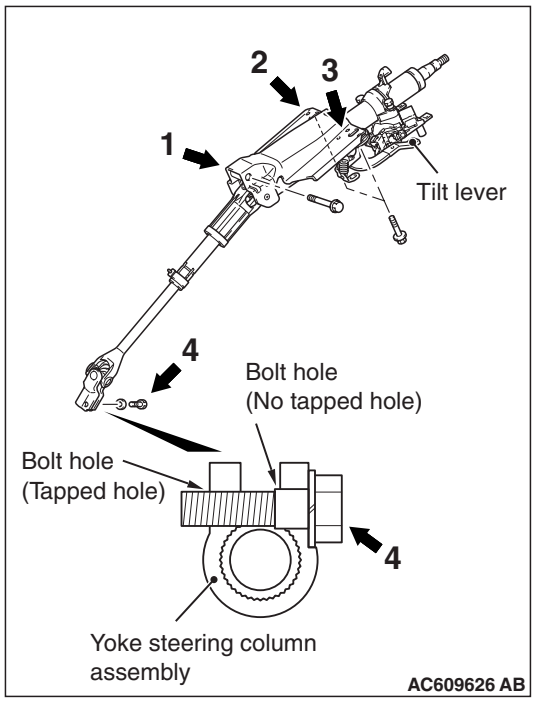


1. Remove the clip (for securing the floor carpet), and turn back the floor carpet.
2. Remove the clip (for securing the steering shaft cover), and then remove the steering shaft cover.

<<C>> STEERING COLUMN SHAFT ASSEMBLY DISCONNECTION



1. Remove the steering column bolt connecting the steering gear to the steering column assembly.
2. Disconnect the steering gear from the steering column assembly while sliding the shaft A to the shaft B with the clip claw as shown in the figure is pinched.
3. Remove the steering column mounting bolt.



INSTALLATION SERVICE POINT

>>A<< STEERING COLUMN SHAFT ASSEMBLY INSTALLATION

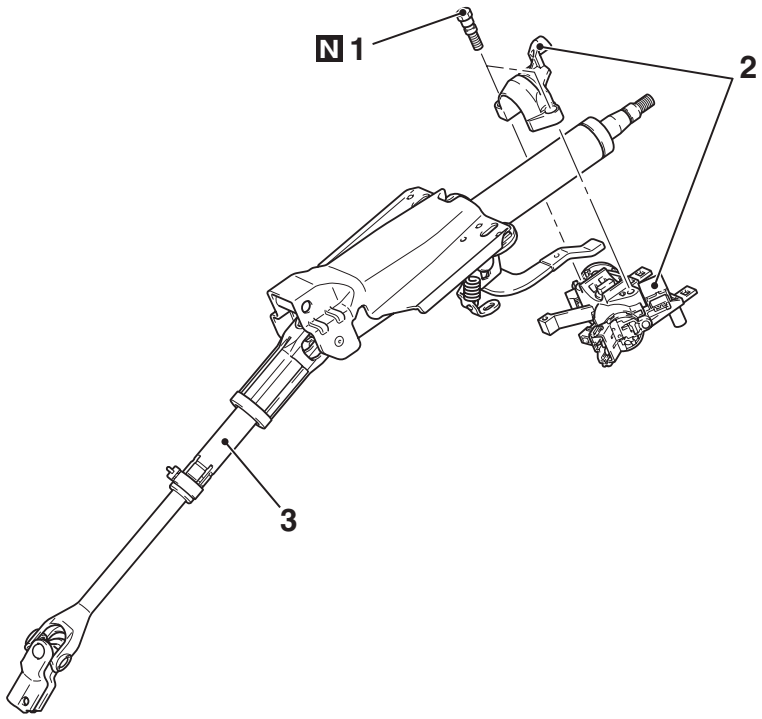
Ensure that the tilt lever is in the lock position, and install the steering column as below.

1. Hand-tighten the mounting bolts in the order of 1, 2, 3, and tighten them in the order of 3, 2, 1, to the specified torque.
2. Assemble the steering column assembly to the steering gear.
3. Insert the bolt connecting the steering column assembly with the steering gear into the non-threaded bolt hole.
4. Tighten the mounting bolt 4 to the specified torque.

Tightening torque:
Mounting bolt 1: 28 ±7 N· m (21 ±5 ft-lb)
Mounting bolt 2, 3: 12 ±3 N· m (102 ±26 in-lb)
Mounting bolt 4: 20 ±5 N· m (15 ±3 ft-lb)

DISASSEMBLY AND ASSEMBLY

M1372011700377

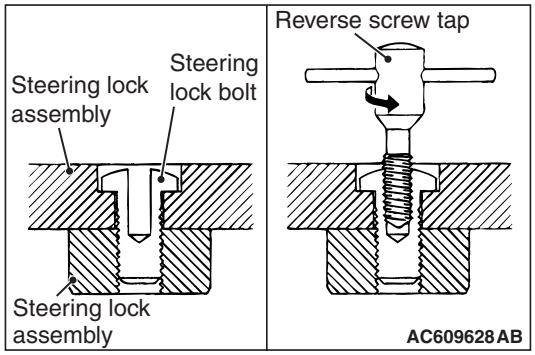


			Disassembly steps			Disassembly steps
<<A>>	>>A<<	1.	Steering locking bolt	>>A<<	2.	Steering lock assembly
					3.	Steering column shaft assembly

TSB Revision

DISASSEMBLY SERVICE POINT

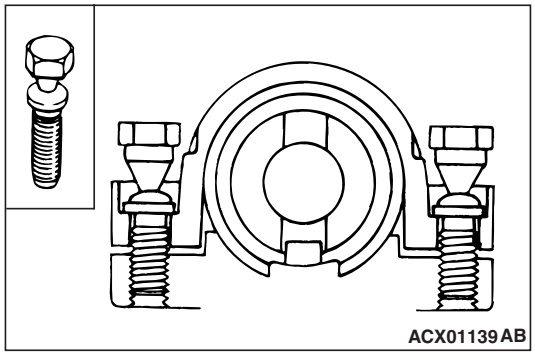
<<A>> SPECIAL BOLT REMOVAL



1. Use a drill to make a hole just deeply enough for the tap to stand on the steering lock bolt.
2. Use a left-hand thread tap to remove the steering lock bolt.

ASSEMBLY SERVICE POINT

>>A<< STEERING LOCK ASSEMBLY/STEERING LOCKING BOLT INSTALLATION



1. When installing the steering lock assembly to the steering column shaft assembly, temporarily assemble the steering lock assembly while aligning it with the boss on the column.
2. Make sure that the steering lock operates normally, and then tighten the steering lock bolt until its head is broken off.

POWER STEERING GEAR BOX AND LINKAGE

REMOVAL AND INSTALLATION

M1372010900970

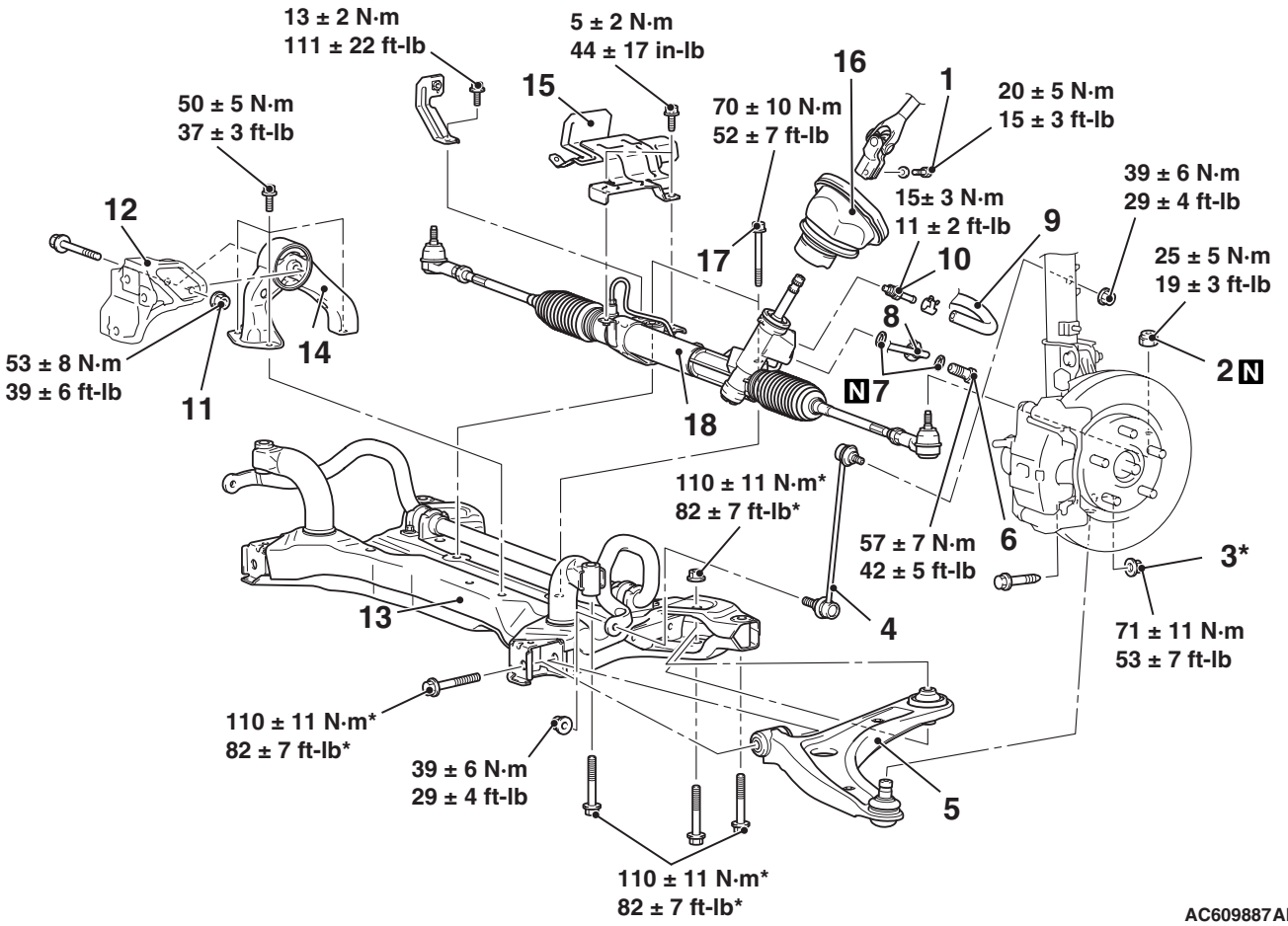
⚠ WARNING

Before removing the steering gear, refer to GROUP 52B, Service Precautions (P.52B-24) and Air Bag Module and Clock Spring (P.52B-367). Center the front wheels. Failure to do so may damage the SRS clock spring and render the SRS system inoperative, risking serious injury.

⚠ CAUTION

The bolts and nuts marked with * are coated with the friction coefficient stabilizer. When removing these parts, make sure that they are free of damage, remove any dust and dirt on the bearing surfaces and the threads, and tighten to the specified torque.

Pre-removal Operation	Post-installation Operation
• Power Steering Fluid Draining (Refer to P.37-17). • Steering Wheel Assembly and Air Bag Module Removal (Refer to P.15-12). • Steering Shaft Cover Removal (Refer to P.32-7). • Engine Room Under Cover Front, Engine Room Side Cover, Front Floor Panel Rear Removal (Refer to GROUP 51 –Under Cover P.51-16). • Front Roll Stopper and Centermember Assembly Removal (Refer to GROUP 32 –Engine Roll Stopper and Centermember P.32-7).	• Front Roll Stopper and Centermember Assembly Installation (Refer to GROUP 32 –Engine Roll Stopper and Centermember P.32-7). • Engine Room Under Cover Front, Engine Room Side Cover, Front Floor Panel Rear Installation (Refer to GROUP 51 –Under Cover P.51-16). • Steering Shaft Cover Installation (Refer to P.32-7). • Steering Wheel Assembly and Air Bag Module Installation (Refer to P.15-12). • Power Steering Fluid Refilling and Bleeding (Refer to P.37-17).



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TSB Revision

Removal steps

1. Steering gear and joint connecting bolt
<<A>> 2. Self-lock nut (Tie-rod end and knuckle connection)
3. Flange nut (Lower arm and knuckle connection)
4. Stabilizer link
5. Lower arm assembly
6. Eye bolt
7. Gasket
8. Pressure hose connection
9. Return hose connection
10. Return tube assembly

Removal steps (Continued)

11. Flange nut
12. Rear roll stopper bolt
<<B>> 13. Front suspension crossmember
14. Rear roll stopper
15. Heat protector
>>A<< 16. Joint cover grommet
17. Flanged bolt
18. Steering gear and linkage

Required Special Tool:

- MB991897 or MB992011: Ball Joint Remover

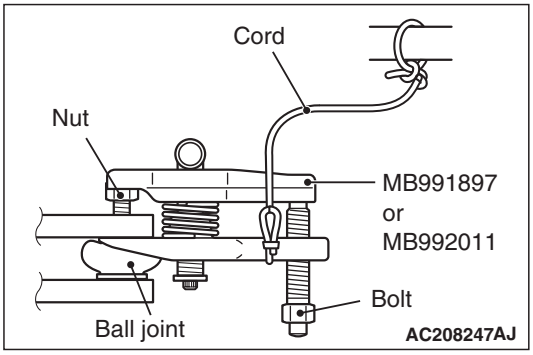
REMOVAL SERVICE POINTS

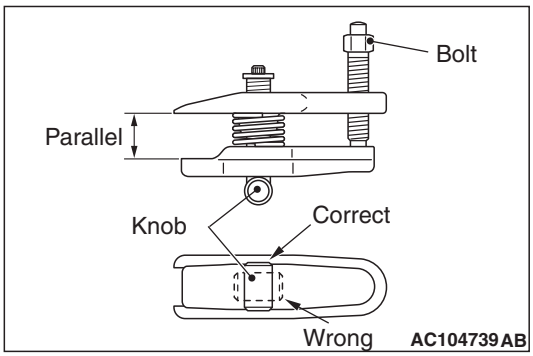
<<A>> SELF-LOCK NUT (TIE-ROD END AND KNUCKLE CONNECTION) REMOVAL

⚠ CAUTION

- **Loosen the self-locking nut (tie-rod end connection) from the ball joint, but do not remove here. Use the special tool.**
- **To prevent the special tool from dropping off, suspend it with a rope.**

1. Install special tool MB991897 or MB992011 as shown in the figure.



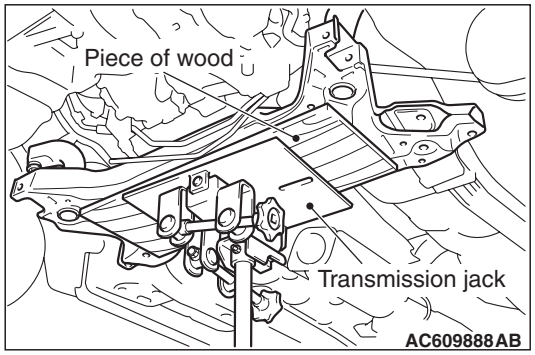


2. Turn the bolt and knob to make the special tool jaws parallel, then hand-tighten the bolt. After tightening, check that the jaws are still parallel.

   NOTE: To adjust the special tool jaws to be parallel, set the orientation of the knob as shown in the figure.

3. Unscrew the bolt to disconnect the ball joint.

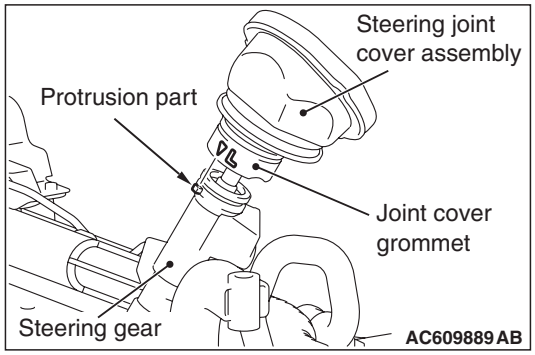
<<B>> FRONT SUSPENSION CROSSMEMBER REMOVAL



1. Jack up and support the crossmember, and remove it.
2. Check the hoses and harnesses for roughness, and then remove the front suspension crossmember with the rear roll stopper and the steering gear and linkage installed.

INSTALLATION SERVICE POINT

>>A<< JOINT COVER GROMMET INSTALLATION



Install the joint cover grommet to the steering gear and linkage by aligning L mark and the protrusion part of gearbox as shown in the figure.

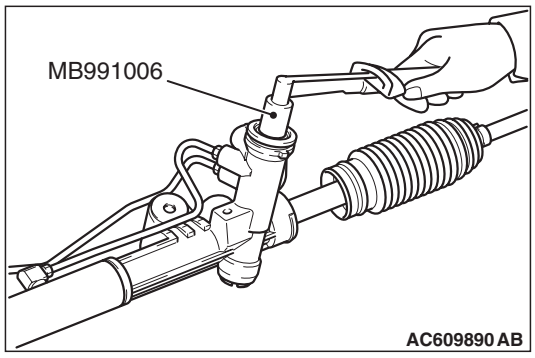
INSPECTION

M1372011000806

PINION TOTAL ROTATION TORQUE CHECK

⚠ CAUTION

Secure the steering gear and linkage to the special mounting point. Fixing the steering gear and linkage to another point could deform or damage the gear housing.



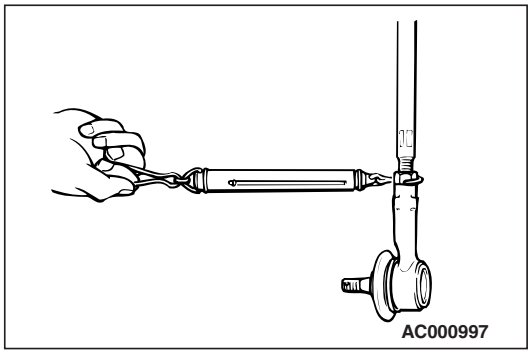
1. Using the special tool preload socket (MB991006) to rotate the pinion at a rate of one turn per 4 to 6 seconds, and then measure the pinion total rotation torque.

   Standard value:
   Total rotation torque: 1.0 –2.0 N· m (0.8 –1.6 in-lb)
   Torque fluctuation: 0.4 N· m (3.5 in-lb) or less

NOTE:
- *During measurement, remove the bellows from the gear housing.*
- *Rotate the pinion by 180° in left and right directions from the neutral position, and measure the pinion total rotation torque.*

2. If the measurement value is outside the standard value, replace the gear housing.

TIE-ROD OSCILLATING TORQUE CHECK

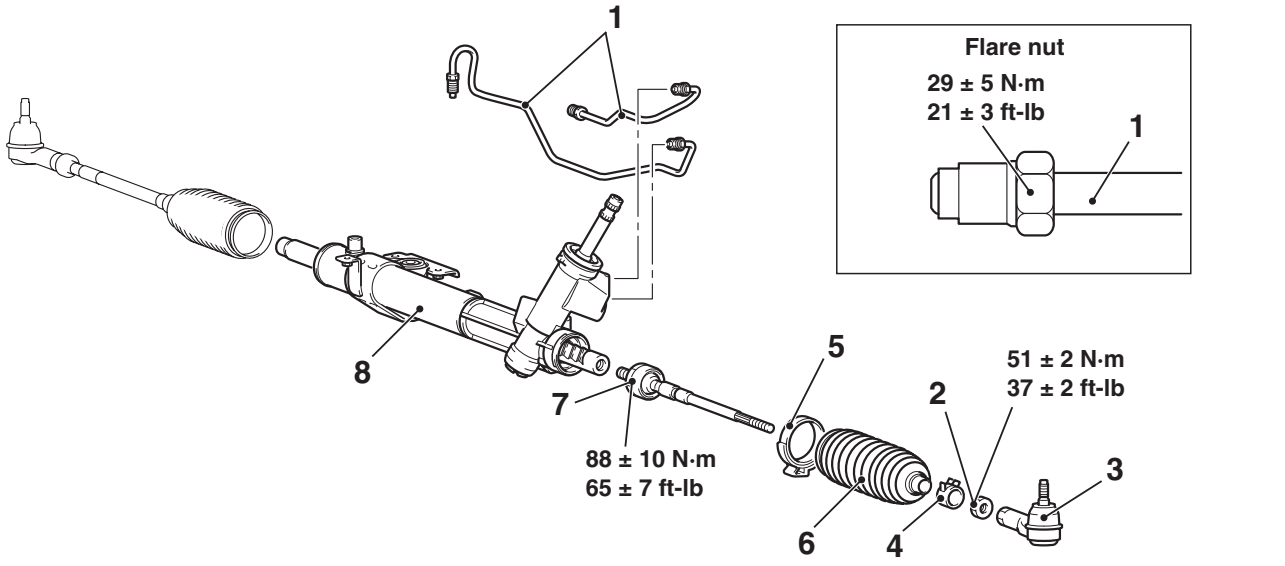

AC000997

1. Swing the tie-rod ten times strongly.
2. Measure the oscillating resistance (oscillating torque) using a spring scale as shown in the figure with the tie-rod end facing downward.

   Standard value:
   5.5 –18 N· m (44 –80 in-lb)
   {1.5 –4.9 N· m (13.2 –43.4 in-lb) }
3. If the measurement is greater than the standard value, replace the tie-rod.
4. If the measurement value is below the standard value, check the ball joint for looseness or scraping feeling. If the ball joint swings smoothly, it is judged to be usable.

DISASSEMBLY AND ASSEMBLY

M1372011100621

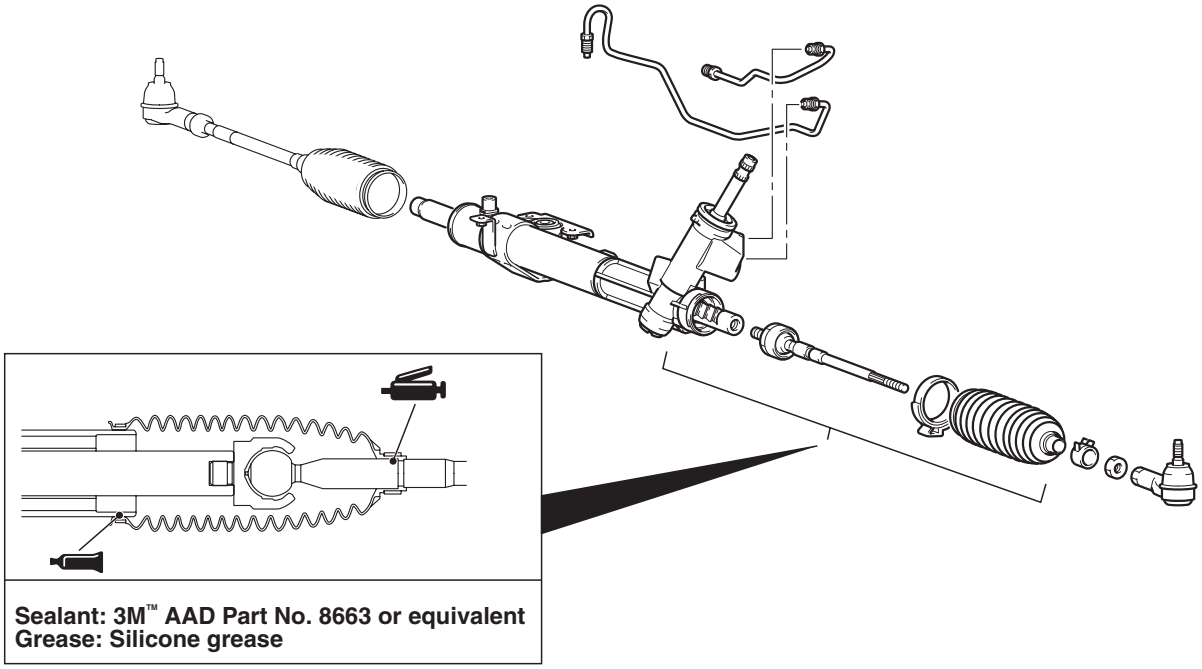


AC609891AB

	Disassembly steps		Disassembly steps
	1. Feed pipe	>>A<<	5. Band
>>B<<	2. Locking nut		6. Bellows
>>B<<	3. Tie-rod end		7. Tie-rod
	4. Clip		8. Gear housing

TSB Revision

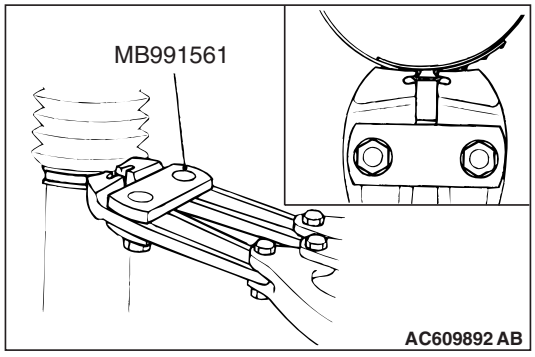
LUBRICATION AND SEALING POINTS



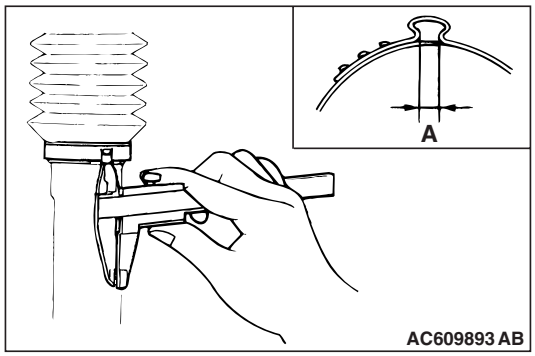
AC609895 AB

ASSEMBLY SERVICE POINTS

>>A<< BAND INSTALLATION



AC609892 AB



AC609893 AB

1. Turn the adjusting bolt for the special tool boot band clipping tool (MB991561) to adjust the opening dimension (W) to the standard value.

   Standard value (W): 2.9mm (0.11 inch)
   When opening dimension is more than 2.9mm (0.11 inch)
   Tighten the adjusting bolt.
   When opening dimension is more than 2.9mm (0.11 inch)
   Loosen the adjusting bolt.

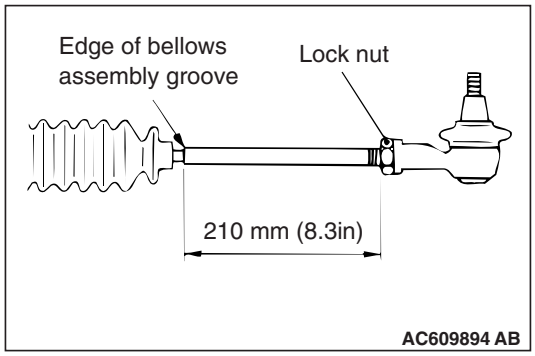
NOTE:
- *The adjusting bolt changes W approximately 0.7 mm for each rotation.*
- *Do not rotate the adjusting bolt more than one rotation.*

⚠ CAUTION
- **Secure the gear housing, and crimp the crimping part of the band firmly with the tip of the special tool.**
- **Crimp the boot band securely until the special tool contacts the stopper.**

2. Use the special tool to crimp the boot band.
3. Check that the crimping width of the boot band (A) is within the range of the standard value.

Standard value(A):2.4 –2.8 mm (0.09 –0.11 inch)
Readjust the value W describad in Step 1 to the following formula, and perform the operation in Step 2 again.
W=5.5-A (Example: When A is 2.9, W is 2.6)
When the crimping width is less than 2.4 mm (0.09 inch)
Remove the boot band, readjust the value W described in Step 1 to the following formula, and perform the Step 2 and 3 using a new boot band.
W=5.5-A (Example: When A is 2.3, W is 3.2)

>>B<< TIE-ROD END/LOCKING NUT INSTALLATION



Screw in the tie-rod to the length shown in the figure, and hand-tighten the locking nut.

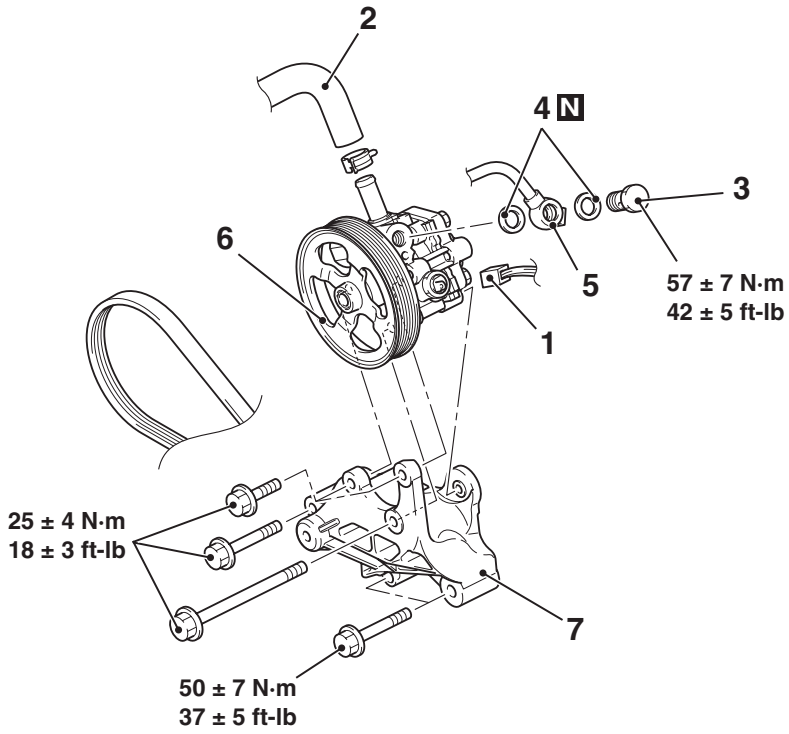
NOTE: Install the steering gear and linkage to the body, adjust the toe-in, and then tighten the locking nut to the specified torque.

POWER STEERING OIL PUMP ASSEMBLY

REMOVAL AND INSTALLATION

M1372005200942

Pre-removal Operation	Post-installation Operation
• Power Steering Fluid Draining (Refer to P.37-17). • Engine Cover Removal (Refer to GROUP 11 –Engine Assembly P.11A-74). • Radiator Condenser Tank Removal (Refer to GROUP 14 –Radiator P.14-26). • Drive Belt Removal (Refer to GROUP 11 –Engine Assembly P.11A-74).	• Drive Belt Installation (Refer to GROUP 11 –Engine Assembly P.11A-74). • Engine Cover Installation (Refer to GROUP 11 –Engine Assembly P.11A-74). • Radiator Condenser Tank Installation (Refer to GROUP 14 –Radiator P.14-26). • Power Steering Fluid Supplying and Bleeding (Refer to P.37-17). • Drive Belt Tension Adjusting (Refer to GROUP 00, Maintenance Service –Drive Belt P.00-59).



AC609896 AB

Removal steps

1. Power steering harness
>>A<< 2. Suction hose
3. Eye bolt
4. Gasket

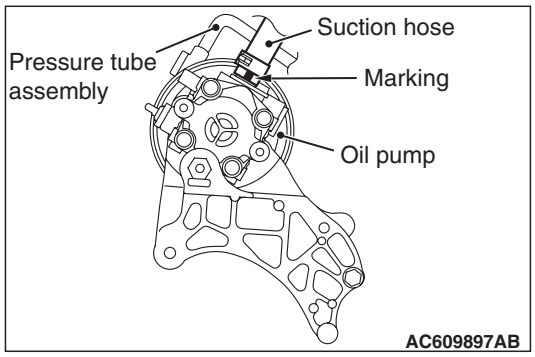
Removal steps (Continued)

5. Pressure tube assembly
6. Power steering oil pump
7. Power steering oil pump bracket

TSB Revision

INSTALLATION SERVICE POINT

>>A<< SUCTION HOSE INSTALLATION



Install the suction hose so that the marking is positioned toward vehicle left side as shown in the illustration.

INSPECTION

M1372005300347

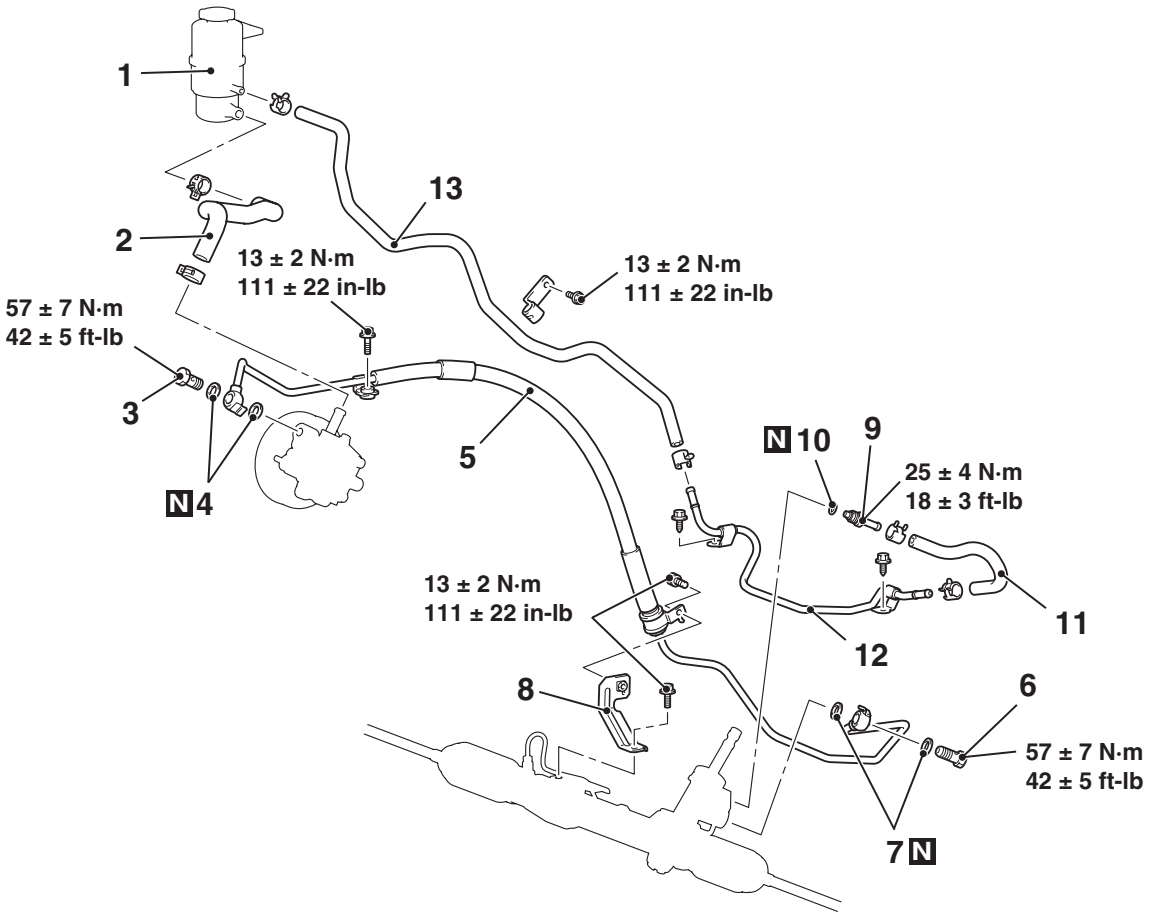
- Check the drive belt for cracks.
- Check the pulley for uneven rotation.

POWER STEERING HOSES

REMOVAL AND INSTALLATION

M1372005701070

Pre-removal Operation	Post-installation Operation
• Power Steering Fluid Draining (Refer to P.37-17). • Engine Cover Removal (Refer to GROUP 11 –Engine Assembly P.11A-74). • Radiator Condenser Tank Removal (Refer to GROUP 14 –Radiator P.14-26). • Drive Belt Removal (Refer to GROUP 11 –Engine Assembly P.11A-74).	• Drive Belt Installation (Refer to GROUP 11 –Engine Assembly P.11A-74). • Engine Cover Installation (Refer to GROUP 11 –Engine Assembly P.11A-74). • Radiator Condenser Tank Installation (Refer to GROUP 14 –Radiator P.14-26). • Power Steering Fluid Supplying and Bleeding (Refer to P.37-17). • Drive Belt Tension Adjusting (Refer to GROUP 00, Maintenance Service –Drive Belt P.00-59).



AC609902 AB

Removal steps

1. Oil reservoir
2. Suction hose
3. Eye bolt
4. Gasket
5. Pressure hose assembly
6. Eye bolt
7. Gasket

Removal steps (Continued)

8. Power steering oil line bracket
9. Return tube
10. Gasket
11. Return hose

>>A<< 12. Return tube
>>A<< 13. Return hose

TSB Revision

INSTALLATION SERVICE POINTS

>>A<< RETURN HOSE INSTALLATION

Install the return hose and return tube so that the markings are positioned as shown in the illustration.